

AIR QUALITY IMPLICATIONS OF ALTERNATIVE FUELS: A SPATIALLY AND TEMPORALLY EXPLICIT LIFECYCLE MODELING APPROACH

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Background and Aims: The current US Renewable Fuel Standard (RFS2) requires increasing amounts of biofuel production through 2022. We use lifecycle assessment, air dispersion modeling, and health risk assessment to estimate air pollution-related health impacts of an additional 7.5 billion gallons of corn grain ethanol and 5 billion gallons of cellulosic ethanol from corn stover.

Methods: *Emissions* – Process-specific emissions for the lifecycle of fuel production and use were extracted from the GREET lifecycle model and allocated to a 12km grid over the continental US, in one hour time steps, during a 1-year model simulation. The lifecycle analysis included feedstock production (mining, farming, or harvesting), conversion to fuel, distribution, and combustion in vehicles, plus the necessary inputs, such as fossil fuels, electricity, and fertilizer, for each step. *Air dispersion* – A state-of-the-science photochemical air dispersion model (CAMx) predicts the fate and transport of emissions, estimating marginal pollution changes attributable to RFS2. We focus here on PM_{2.5} and ozone. *Health risk assessment* – Our mortality estimates employ concentration-response functions from Pope et al. (2002) for PM_{2.5} and from Bell et al. (2004) for ozone, using EPA's BENMAP model.

Results: Preliminary results suggest that the RFS2 ethanol scenario will annually yield 23 more deaths due to ozone, and 112 more deaths due to PM_{2.5}, relative to an energy equivalent amount of gasoline. This is equivalent to a value of statistical life (VSL) based increase in public health burden of 0.09 USD per gasoline equivalent gallon (0.02 USD/liter).

Conclusions: Preliminary results suggest that the RFS2 will worsen air-quality and related mortality in the US. However, transportation fuel choice impacts society in many ways, and it is important to quantify and compare all impacts when considering changes in fuels.

References:

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